Volume 22 Study D-I-B

STATE OF ALASKA

Jay S. Hammond, Governor

Annual Performance Report for

ECOLOGY OF REARING FISH

by

Dennis J. Hubartt

ALASKA DEPARTMENT OF FISH AND GAME
Ronald O. Skoog, Commissioner

SPORT FISH DIVISION
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RESEARCH PROJECT SEGMENT

State: ALASKA Name: Sport Fish Investigations of Alaska

Project No.: F-9-13

Study No.: D-I Study Title: A STUDY OF LAND USE ACTIVITIES AND THEIR RELATIONSHIP TO THE SPORT FISH RESOURCES IN ALASKA

Job No.: D-I-B Job Title: Ecology of Rearing Fish

Cooperator: Dennis J. Hubartt

Period Covered: July 1, 1980 to June 30, 1981

ABSTRACT

In 1979, the Sport Fish Land Use Project joined with the U.S. Department of Agriculture Forestry Sciences Laboratory and the National Marine Fisheries Service Auke Bay Laboratory in a cooperative research effort to study the impacts of clearcut logging on salmonid production in southeast Alaska. Specifically, the program examined the effects of the removal of streamside vegetation on the aquatic and estuarine productivity of Trap Bay Creek, Tenakee Inlet.

During the 1980 field season, the Land Use Project contributed to the program by examining the spring movements of salmonids and cottids, monitoring the escapement of adult salmonids, and conducting a complete benthological survey of the watershed.

A total of 1,500 juvenile coho salmon, Oncorhynchus kisutch (Walbaum); 250 juvenile Dolly Varden char, Salvelinus malma (Walbaum); and 460 cottids, Cottus sp. were captured in five downstream migrant traps (fyke nets) at mainstream and tributary sites.

The mean lengths of all juvenile coho, juvenile char, and cottids captured in the five nets were 75.1 mm, 93.0 mm, and 68.8 mm, respectively. The mean weights for these three species were 5.2 g for cohos, 10.5 g for char, and 5.1 g for cottids. Analyses of the length data indicated statistically significant differences in the mean lengths of coho and char captured at different locations.

Counts of upstream migrant salmonids at the Trap Bay weir totaled 4,800 pink salmon, Oncorhynchus gorbuscha (Walbaum); 2,210 Dolly Varden char, 41

chum salmon, Oncorhynchus keta (Walbaum); 29 coho salmon; 19 cutthroat trout, Salmo clarki Richardson; and 2 rainbow trout, Salmo gairdneri Richardson.

Sampling of invertebrate drift and benthos populations was carried out at selected sites throughout the watershed. Data analysis was not completed in time to be included in this report.

BACKGROUND

Studies performed under Job D-1-B, Ecology of Rearing Fish, have included the development and evaluation of population estimation techniques for rearing salmonids (Elliott and Reed, 1973), the study of distribution, movement, and abundance of rearing salmonids in a logged watershed (Elliott and Reed, 1974; and Elliott, 1975), the effects of debris removal on rearing fish and aquatic insects in the same watershed (Elliott, 1976; 1977; and 1978), and the study of fish and aquatic insect populations, and selected habitat parameters in logged and unlogged streams (Hubartt, 1980).

In 1979, the Land Use Project joined with the Forestry Sciences Laboratory and the National Marine Fisheries Service in a cooperative research program to determine the effect of clearcut logging and the removal of streamside vegetation on aquatic productivity. The research program was centered at Trap Bay, Tenakee Inlet, where collection of baseline data on the productivity of the system was begun in the spring of 1980.

A list of common names, scientific names, and abbreviations of all species mentioned in this report is presented in Table 1.

RECOMMENDATIONS

Research

1. Continue to monitor the effects of logging debris removal on juvenile salmonids and macrobenthos communities in selected tributaries of Starrigavin Creek.

2. Determine if clearcut logging practices effect aquatic productivity in small streams by the following means:

    a. Continue to examine spring movements of juvenile salmonids and cottids at Trap Bay Creek.

    b. Continue to examine macrobenthos communities and their habitats at Trap Bay Creek.

    c. Compare macrobenthos communities and their habitats in logged and unlogged streams.

Table 1. List of common names, scientific names, and abbreviations.

Common Name	Scientific Name and Author	Abbreviation
Pink salmon	Oncorhynchus gorbuscha (Walbaum)	PS
Chum salmon	Oncorhynchus keta (Walbaum)	CS
Coho salmon	Oncorhynchus kisutch (Walbaum)	SS
Dolly Varden	Salvelinus malma (Walbaum)	DV
Rainbow trout	Salmo gairdneri Richardson	RT
Cutthroat trout	Salmo clarki Richardson	CT
Sculpin	Cottus spp.	SSC

d. Compare various population parameters, such as abundance, growth, and survival of juvenile salmonids in logged and unlogged streams.

e. Determine the relationships between quantifiable population parameters for aquatic insects and rearing salmonids, and quantifiable habitat parameters in small streams.

Management

1. Continue to publish significant results gathered by this job.

2. Advise management biologists of improvements in field techniques and of relevant findings.

OBJECTIVES

1. Continue to monitor the effects of debris removal in Spring Pond Creek.

2. Determine if differences in aquatic productivity occur in tributaries of logged and unlogged watersheds.

   a. Determine the number, timing, and age-weight-length relationships of salmonids at Trap Bay Creek.

   b. Determine the population status, standing crop, and growth characteristics of macrobenthos at Trap Bay.

3. Determine the overwinter survival of rearing salmonids in small tributaries of logged and unlogged streams.

TECHNIQUES USED

Downstream Migrants

Downstream migrant salmonids and cottids were captured by using fyke nets, with live boxes attached, from April 29 through June 20, 1980. Five locations at Trap Bay were sampled (Figure 1) and have abbreviated site names as follows:

Location	Site Name
Unit 9 stream	FYK1
Unit 3a stream	FYK2
Control creek	FYK3
Lower mainstream	FYKLM
Upper mainstream	FYKUM

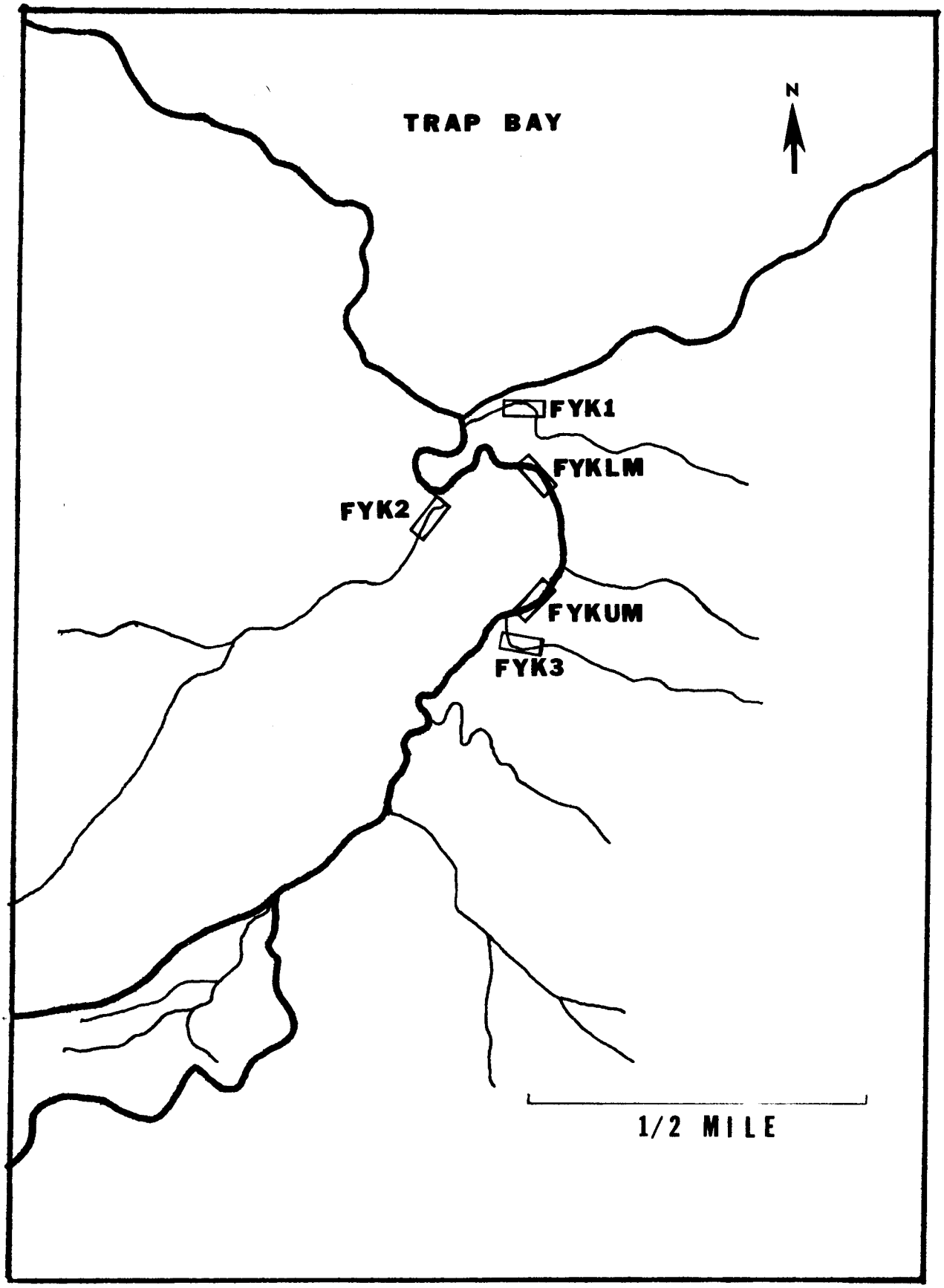


FIGURE 1. TRAP BAY FYKE NET LOCATIONS.

FYK1, FYK2, and FYK3 on the tributary streams formed complete barriers to fish movement, except during occasional high water periods. Fyke nets FYKLM and FYKUM, located on the mainstream, sampled about one-half of the mainstream flow.

All nets were visited daily, during which time each captured fish was identified, counted, measured (nearest 1 mm fork length), weighed (nearest 0.1 gram), and released downstream. Scales were collected from every tenth coho salmon. Every tenth Dolly Varden char was sacrificed so that age (from otoliths), sex, and maturity could be determined.

Upstream Migrants

To determine the number and timing of upstream migrants into Trap Bay Creek, a wooden "horse and deck" weir similar to that described by Armstrong (1965) was built and operated from August 13 through October 20, 1980. The weir was about 50 feet wide and contained an upstream "V-trap" and a downstream trap with a "wolf" type door. The traps were checked at least twice a day and all species were identified, counted and released. Pink salmon were counted and their length (mid-eye to fork to the nearest 1 mm), weight (to the nearest 0.1 km), sex, and maturity data were obtained. All Dolly Varden char were counted and their length (nearest 1 mm fork length), weight (nearest 0.1 g), age (otoliths were collected from every tenth char), sex, and maturity data were obtained.

Data derived from fyke nets and weir catches were examined for the following: (1) relationships between movement and time, water temperature, and water level; (2) mean lengths; (3) mean weights; (4) length-frequency distributions; (5) weight-length relationships; and (6) age-length relationships. Data were analyzed by using various Biomedical Computer Programs (BMDP) via a remote terminal linked to a Honeywell 6000 computer located at the University of Alaska, College, Alaska. The BMDP programs were the February 7, 1975 revision (see Dixon and Brown, 1979).

Macrobenthos Sampling

Stream macrobenthos were collected in two ways at Trap Bay Creek; by collecting invertebrate drift samples and by taking benthos samples. Drift samples yield information on the life history of macrobenthos and provide data for correlation with salmonid food habits. Benthos samples are collected directly from the stream bed and provide data on the community structure and growth characteristics of invertebrate populations. Fifteen collection sites representing various types of treatment were selected in the watershed (Figure 2 and Appendix Table 3).

Invertebrate drift samples were collected with tapering nets constructed of 280 micron mesh nitex and having an opening of 0.093 m^2. When a sample was taken, two nets were anchored in the stream and allowed to operate for either 24 hours or about 14 hours (overnight). Data concerning the location, date, time, water temperature, water velocity (at the net's opening), and water depth were recorded. After the prescribed operating time had elapsed, the entire contents of one net was preserved in a 1-quart plastic

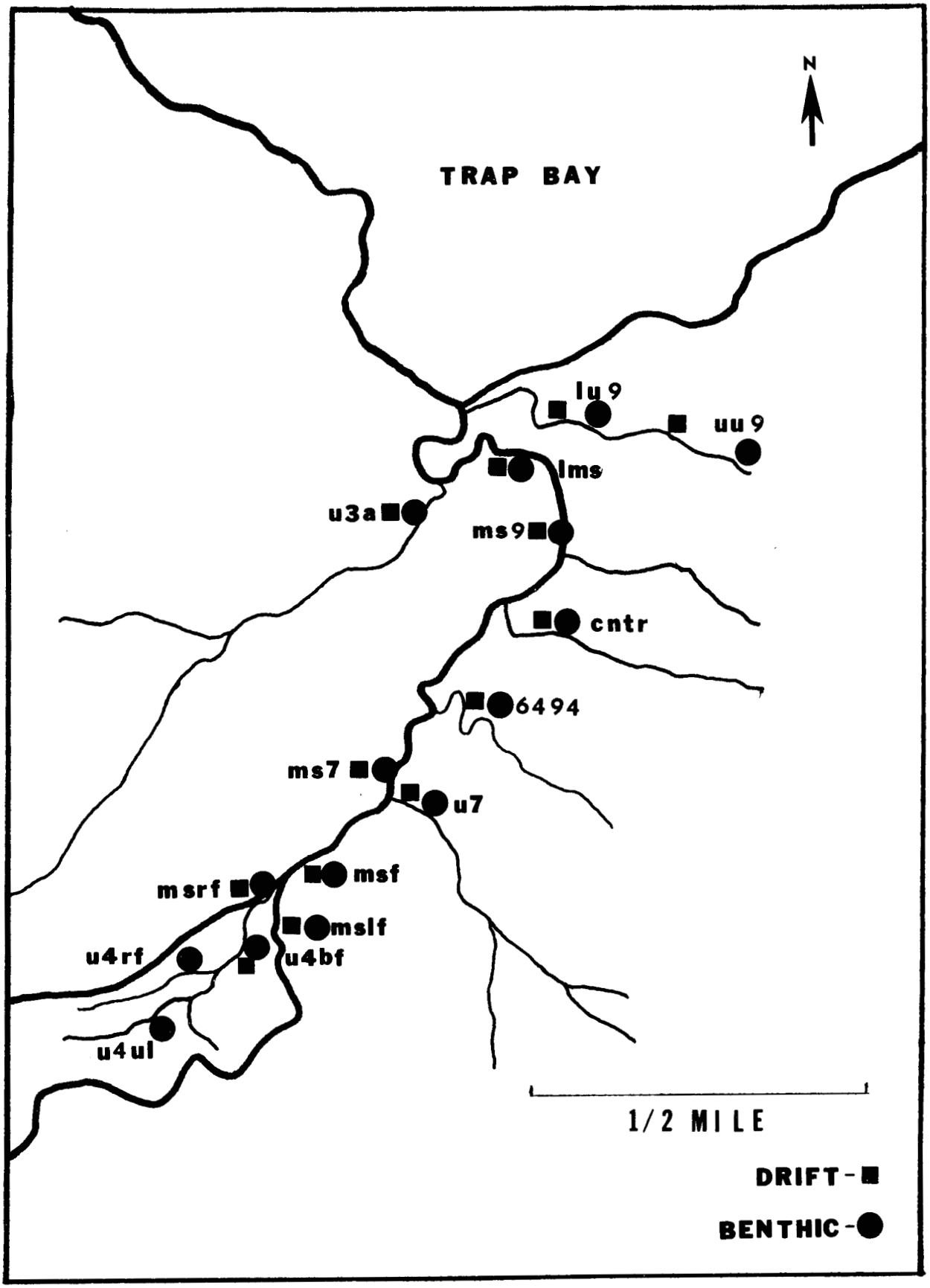


FIGURE 2. DRIFT AND BENTHIC SITES.

bottle and cataloged for sorting and identification. The contents from the remaining net was dried and weighed to determine the total amount of organic drift.

Benthos samples were taken by two methods. A 0.33 m^2 Hess sampler was used to collect benthos samples during July. Five randomly located samples were taken at each site every 2 weeks. Additionally, invertebrate populations were estimated by the removal method (Carle, 1976) to serve as a check.

Beginning in August, low streamflows necessitated the use of a smaller sampler. A 0.1 m^2 Hess sampler that could be used in shallow water was designed and built to solve this problem. When using this device, three samples were taken (each consisting of a 1-minute dig) at each of 15 sample sites (Figure 2). The following data were recorded at each site: location, date, time, water temperature, water velocity, water depth, the most abundant substrate size, the next most abundant substrate size, and the degree of embeddedness of cobbles greater than 63.5 mm (Bjornn et al., 1977). Water temperatures were obtained with hand-held thermometers and were measured to the nearest °C. Water velocities were obtained either by measuring the time it took for a float to traverse a measured distance or by the use of a water flow meter. Substrate and embeddedness were classified according to the ranking scheme presented in Table 2 (Bjornn et al., 1977).

Invertebrate samples were preserved in 70% ethanol and sent to a laboratory where individual specimens were sorted from debris, identified to genus or species, and counted.

A selected number of benthos and drift samples were set aside for special analysis. Specimens were identified and counted, then measured to the nearest millimeter. Organisms were then dried at 105°C for 4 hours, weighed, incinerated at 550°C for 1 hour, and weighed again. The ash-free dry weight was calculated from the difference between the two weights.

All invertebrate identification, measuring and weighing were conducted by Taxon Aquatic Research Service in Corvallis, Oregon.

FINDINGS

Downstream Migrants

Juvenile coho salmon were the most numerous species captured by the five fyke nets. Peak movement occurred on May 19 and 20. Daily catches of juvenile cohos for each of the fyke nets are recorded in Table 3.

The mean length of the 1,552 juvenile cohos captured in all fyke nets combined was 75.1 mm (S.D. = 12.2 mm) with a range of 34 to 131 mm. The mean weight of a subsample of 612 juvenile cohos was 5.2 grams with a standard deviation of 2.2 grams. The weights ranged from 0.6 to 17.8 grams.

Table 2. Ranking scheme used to classify streambottom substrates and cobble embeddedness.

Rank	Substrate Classification Substrate Size	
1	organic debris	
2	< 1.58 mm	(< 0.06 inches)
3	1.58 to 6.35 mm	(0.06 to 0.25 inches)
4	6.35 to 25.4 mm	(0.25 to 1.00 inches)
5	25.40 to 63.50 mm	(1.00 to 2.50 inches)
6	63.50 to 127.00 mm	(2.50 to 5.00 inches)
7	127.00 to 254.00 mm	(5.00 to 10.00 inches)
8	> 254.00 mm	(> 10.00 inches)

Rank	Cobble Embeddedness Classification Embeddedness	Percent
1	completely embedded	100
2	3/4 embedded	75
3	1/2 embedded	50
4	1/4 embedded	25
5	unembedded	0

Table 3. Numbers of juvenile coho salmon captured in fyke nets at Trap Bay, spring, 1980.

DATE	FYK1	FYK2	FYK3	FYKUM	FYKLM	TOTAL
4/29	3	1	*	*	*	4
4/30	*	0	2	*	*	2
5/1	0	0	1	*	*	1
5/2	3	2	0	*	*	5
5/3	49	8	3	*	*	60
5/4	7	4	2	*	*	13
5/5	10	3	1	*	*	14
5/6	17	2	4	*	*	23
5/7	4	26	2	*	*	32
5/8	7	12	4	*	*	23
5/9	19	1	4	7	6	37
5/10	30	6	3	6	7	52
5/11	2	9	1	9	2	23
5/12	26	5	2	2	5	40
5/13	4	24	4	11	23	66
5/14	7	32	1	13	21	74
5/15	0	10	3	7	21	41
5/16	0	7	7	13	23	50
5/17	0	3	2	2	2	49
5/18	22	27	3	2	10	64
5/19	*	118	7	0	58	183
5/20	0	16	2	14	53	85
5/21	1	14	0	5	23	43
5/22	0	10	4	4	12	30
5/23	1	7	3	1	3	15
5/24	6	2	1	0	14	23
5/25	16	7	2	0	9	34
5/26	19	8	2	14	20	63
5/27	19	10	3	7	19	58
5/28	4	14	0	15	7	40
5/29	3	10	0	4	27	44
5/30	1	5	2	3	19	30
5/31	3	19	0	0	8	30
6/1	6	13	0	3	4	26
6/2	0	2	0	2	8	12
6/3	7	2	0	2	5	16
6/4	1	2	3	3	4	13
6/5	10	0	0	0	4	14
6/6	11	5	0	0	0	16
6/7	13	1	1	3	0	18
6/8	25	0	2	*	*	27
6/9	*	*	*	*	*	0
6/10	*	*	*	*	*	0
6/11	*	*	*	*	*	0

Table 3. (Cont'd.) Numbers of juvenile coho salmon captured in fyke nets at Trap Bay, spring, 1980.

DATE	FYK1	FYK2	FYK3	FYKUM	FYKLM	TOTAL
6/12	*	*	*	*	*	0
6/13	*	*	*	*	*	0
6/14	11	13	8	*	*	32
6/15	1	5	1	*	*	7
6/16	*	*	*	*	*	0
6/17	10	0	2	*	*	12
6/18	0	3	1	*	*	4
6/19	1	0	0	*	*	1
6/20	3	1	2	*	*	6
TOTAL	382	469	95	152	457	1,555

* Fyke net was not operating.

Length-frequency distributions for young cohos captured in all the nets combined and in each individual net are presented in Figures 3 and 4, respectively. Mean lengths, standard deviations, and sample sizes are included in these figures.

T-tests comparing the mean lengths of cohos sampled at the five fyke nets indicated that the mean lengths of juvenile coho captured at the FYK2 net were significantly greater than those captured at other sites. Ten tests were conducted which compared all possible pairs of sites. The only tests that indicated no significant differences between mean lengths ($P > .05$) were those that compared FYK1 and FYK3, FYK1 and FYKLM, and FYK3 and FYKLM. In general, mean lengths were greatest at FYK2, followed by FYK1, FYK3, FYKLM, and FYKUM, respectively.

Weight-length relationships of juvenile cohos were found to be similar at each of the fyke net locations. Figure 5 displays the weight-length regression lines and the regression equations for young coho captured at all the nets combined and at each individual net. The sample sizes (n) and r^2 values are as follows:

Location	n	r^2
All nets	610	0.72
FYK1	200	0.77
FYK2	175	0.64
FYK3	37	0.70
FYKLM	133	0.68
FYKUM	65	0.80

These values indicate that the correlations between the logarithm of weight (log w) and the logarithm of fork-length (log FL) are all significant at the .001 level.

The age-length relationships were also similar at each of the fyke net locations with age 1+ cohos composing from 63 to 76% of the samples, age 2+ cohos composing from 23 to 34% of the samples, and age 3+ cohos composing from 0.0 to 3% of the samples. The mean lengths, standard deviations, size ranges, sample sizes, and sample percentages for each age group at each fyke net location are presented in Table 4.

T-tests comparing mean lengths of age 1+ coho at the different sites also indicated that FYK2 cohos were significantly larger ($P < .05$) than cohos sampled at other locations, and that age 2+ cohos were also significantly larger, except in the case of FYK3 where no difference was indicated.

The highest catches of juvenile Dolly Varden char occurred from May 13 through May 19. However, the daily catch records did not indicate any large downstream movements (Table 5).

The mean length of 260 young char captured in all fyke nets was 93.0 mm with a standard deviation of 24.4 mm and a range of 40 to 155 mm. The mean weight of a subsample of 107 young char was 10.5 grams with a standard deviation of 5.8 grams. These weights ranged from 1.7 to 29.3 grams.

Figure 3. Length-frequency distributions of juvenile coho salmon captured in five fyke nets, in the FYKLM net, and in the FYKUM net at Trap Bay, southeast Alaska, 1980.

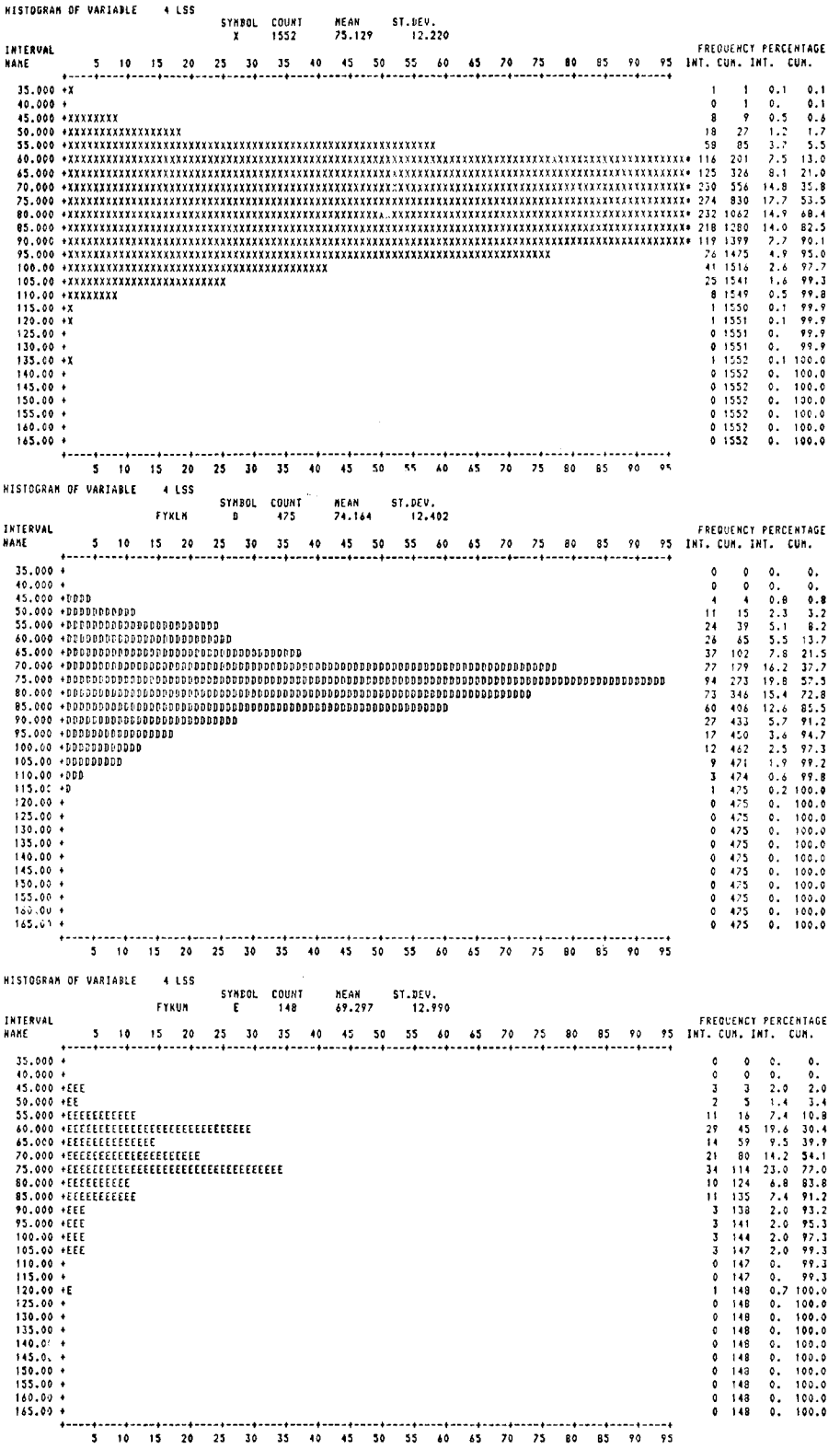
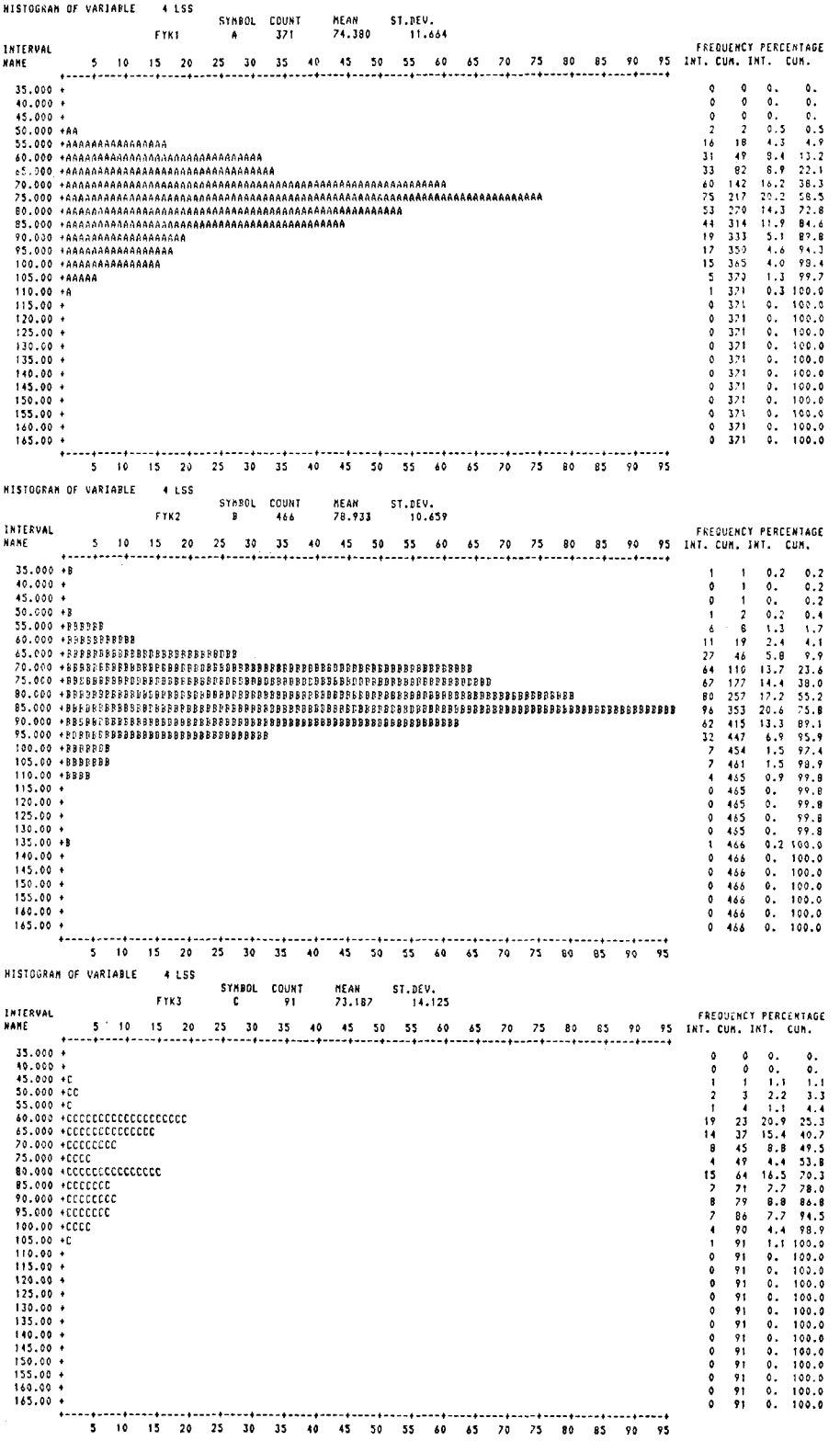


Figure 4. Length-frequency distributions of juvenile coho salmon captured in the FYK1 net, in the FYK2 net, and in the FYK3 net at Trap Bay, southeast Alaska, 1980.



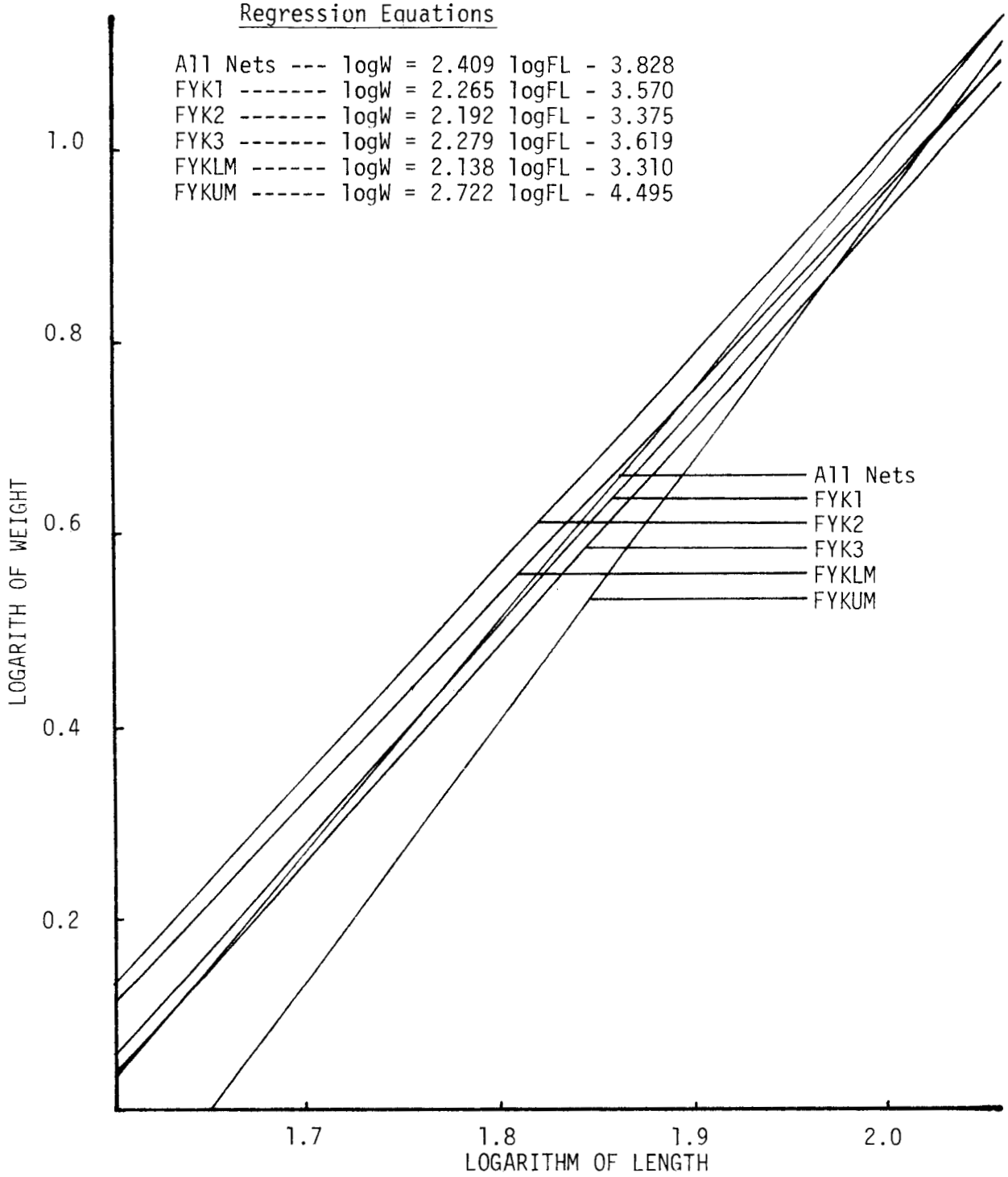


Figure 5. Weight-length regression lines for juvenile coho salmon captured in five fyke nets, in the FYK1 net, in the FYK2 net, in the FYK3 net, in the FYKLM net, and in the FYKUM net at Trap Bay, southeast Alaska, 1980.

Table 4. Mean lengths ($\bar{X}$), standard deviations (S.D.), size ranges (Range), sample sizes (n), and percentages of the samples (%) by age group of juvenile coho salmon captured at five fyke net locations at Trap Bay, southeast Alaska, 1980.

Site	Age Group 1					Age Group 2					Age Group 3	
	$\bar{X}$ (mm)	S.D.	Range (mm)	n	%	$\bar{X}$ (mm)	S.D.	Range (mm)	n	%	n	%
FYK1	71.8	7.8	47-96	125	65	82.2	8.3	70-101	64	33	3	2
FYK2	76.7	9.0	50-100	103	70	88.5	10.7	70-131	43	29	1	1
FYK3	65.3	11.7	43-85	24	63	83.7	8.1	73-104	13	34	0	0
FYKLM	65.6	8.0	41-86	70	76	79.3	9.1	67-103	21	23	1	1
FYKUM	64.1	8.3	49.83	43	74	84.0	12.7	66-116	15	16	0	0

Table 5. Numbers of juvenile Dolly Varden char captured in fyke nets at Trap Bay, spring, 1980.

DATE	FYK1	FYK2	FYK3	FYKUM	FYKLM	TOTAL
4/29	0	4	*	*	*	4
4/30	*	1	0	*	*	1
5/1	0	0	0	*	*	0
5/2	0	0	0	*	*	0
5/3	4	0	1	*	*	5
5/4	1	0	0	*	*	1
5/5	2	0	0	*	*	2
5/6	0	0	0	*	*	0
5/7	0	8	2	*	*	10
5/8	0	1	0	*	*	1
5/9	0	0	1	0	1	2
5/10	1	0	0	4	0	5
5/11	1	2	0	0	1	4
5/12	3	2	0	1	0	6
5/13	1	16	0	1	1	19
5/14	1	9	0	1	4	15
5/15	1	4	0	0	7	12
5/16	0	0	0	2	9	11
5/17	0	3	0	0	10	13
5/18	5	1	0	1	6	13
5/19	*	0	2	0	14	16
5/20	0	1	1	4	3	9
5/21	0	1	0	0	3	4
5/22	0	0	1	0	1	2
5/23	0	0	1	0	0	1
5/24	2	0	0	0	0	2
5/25	2	0	0	0	3	5
5/26	2	0	1	0	5	8
5/27	3	1	2	3	3	12
5/28	3	1	0	1	0	5
5/29	1	1	0	0	8	10
5/30	0	3	1	0	3	7
5/31	0	0	0	0	2	2
6/1	1	0	0	0	0	1
6/2	0	0	1	0	1	2
6/3	1	0	0	0	2	3
6/4	4	1	0	0	0	5
6/5	5	1	0	0	0	6
6/6	2	0	1	0	1	4
6/7	5	0	0	1	0	6
6/8	4	0	0	*	*	4
6/9	*	*	*	*	*	0
6/10	*	*	*	*	*	0
6/11	*	*	*	*	*	0

Table 5. (Cont'd.) Numbers of juvenile Dolly Varden char captured in fyke nets at Trap Bay, spring, 1980.

DATE	FYK1	FYK2	FYK3	FYKUM	FYKLM	TOTAL
6/12	*	*	*	*	*	0
6/13	*	*	*	*	*	0
6/14	4	3	0	*	*	7
6/15	0	1	0	*	*	1
6/16	*	*	*	*	*	0
6/17	3	0	0	*	*	3
6/18	0	0	0	*	*	0
6/19	3	0	0	*	*	3
6/20	0	1	0	*	*	1
TOTAL	65	66	15	19	88	253

* Fyke net was not operating.

Length-frequency distributions for juvenile char captured in all the nets combined and in each individual net are presented in Figures 6 and 7, respectively. Mean lengths, standard deviations, and sample sizes are included in these figures.

T-tests indicated that, as was the case with young coho, juvenile Dolly Varden char captured in the FYK2 net were significantly larger ($P < .05$) than those captured in other locations. Ten tests were conducted which compared all possible pairs of sites, and the tests that indicated no significant differences between mean lengths ($P < .05$) were as follows: FYK1 and FYKLM, FYK1 and FYKUM, FYK3 and FYKLM, FYK3 and FYKUM, and FYKLM and FYKUM. Char captured at FYK2 were the largest followed by those from FYKLM, FYK1, FYKUM, and FYK3.

Weight-length relationships of juvenile Dolly Varden char were nearly the same at all locations with one exception. Figure 8 presents the weight-length regression lines and the regression equations for young char captured at all the nets combined and at each individual net. The sample sizes (n) and r^2 values are as follows:

Location	n	r^2
All nets	108	0.91
FYK1	21	0.93
FYK2	49	0.78
FYK3	6	0.61
FYKLM	23	0.98
FYKUM	8	0.91

These values indicate that the correlations between the logarithm of weight (log w) and the logarithm of fork-length (log FL) are significant at the 0.001 level with respect to the data from all the nets, from FYK1, from FYK2, and from FYKLM. The correlation of weights and lengths sampled at FYKUM is significant at the 0.01 level; however, primarily due to the small sample size ($n = 6$), the correlation is not significant even at the 0.05 level for the FYK3 data.

The daily catch records for cottids captured in the five fyke nets (Table 6) did not indicate any major downstream movements.

The mean length of 467 cottids captured in all fyke nets was 68.8 mm with a standard deviation of 12.1 mm and a range of 38 to 101 mm. The mean weight of a subsample of 137 cottids was 5.1 grams with a standard deviation of 2.3 grams and a range of 1.2 to 13.6 grams.

Length-frequency distributions for cottids captured in all the nets and in each individual net are presented in Figures 9 and 10, respectively. These figures also include mean lengths, standard deviations, and sample sizes.

T-tests were conducted to compare mean lengths from all possible pairs of locations. Mean lengths of cottids collected at FYK1 and FYKLM and at FYKLM and FYKUM were significantly different ($P < .05$).

Figure 6. Length-frequency distributions of juvenile Dolly Varden char captured in five fyke nets, in the FYKLM net, and in the FYKUM net at Trap Bay, southeast Alaska, 1980.

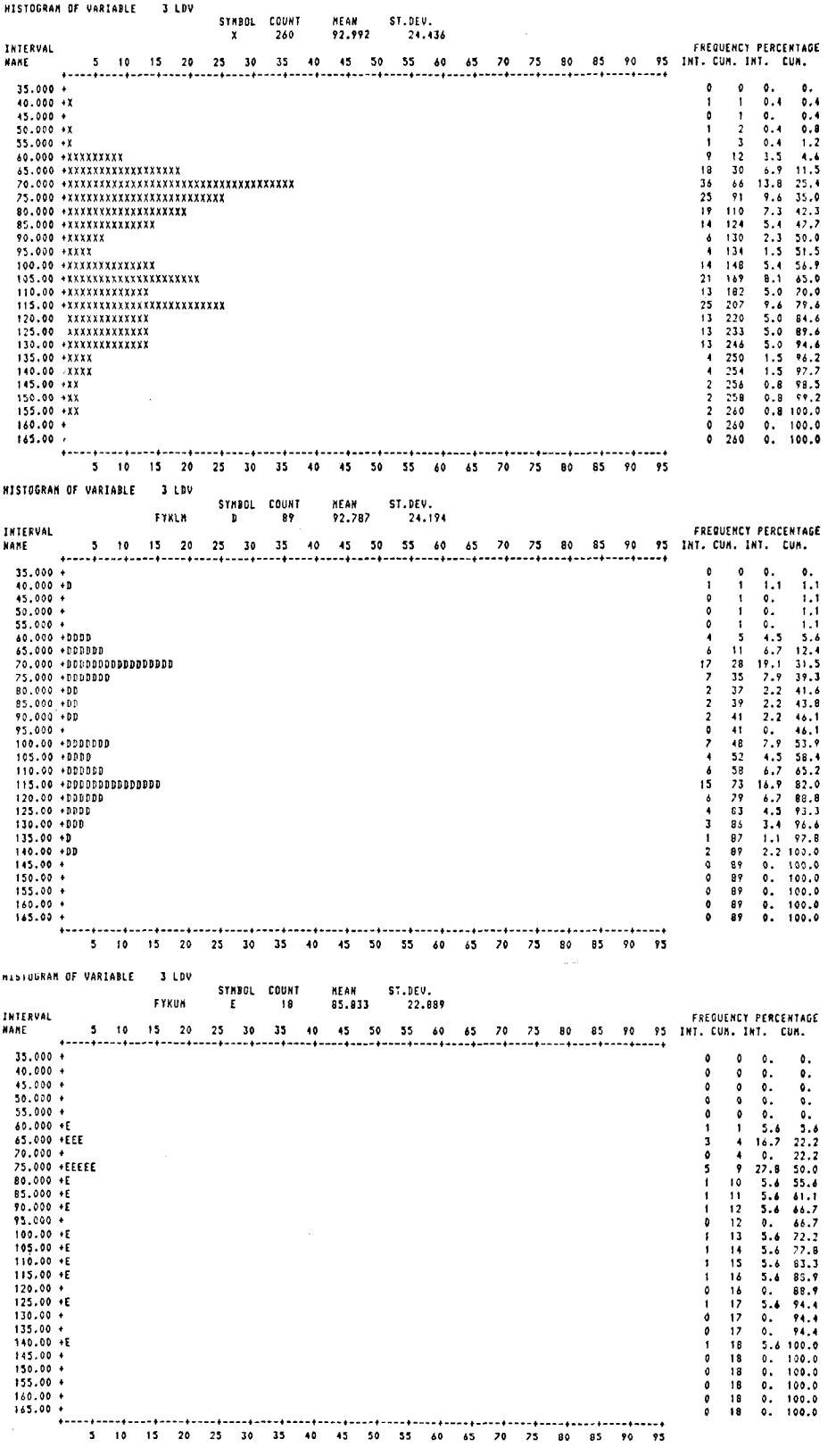
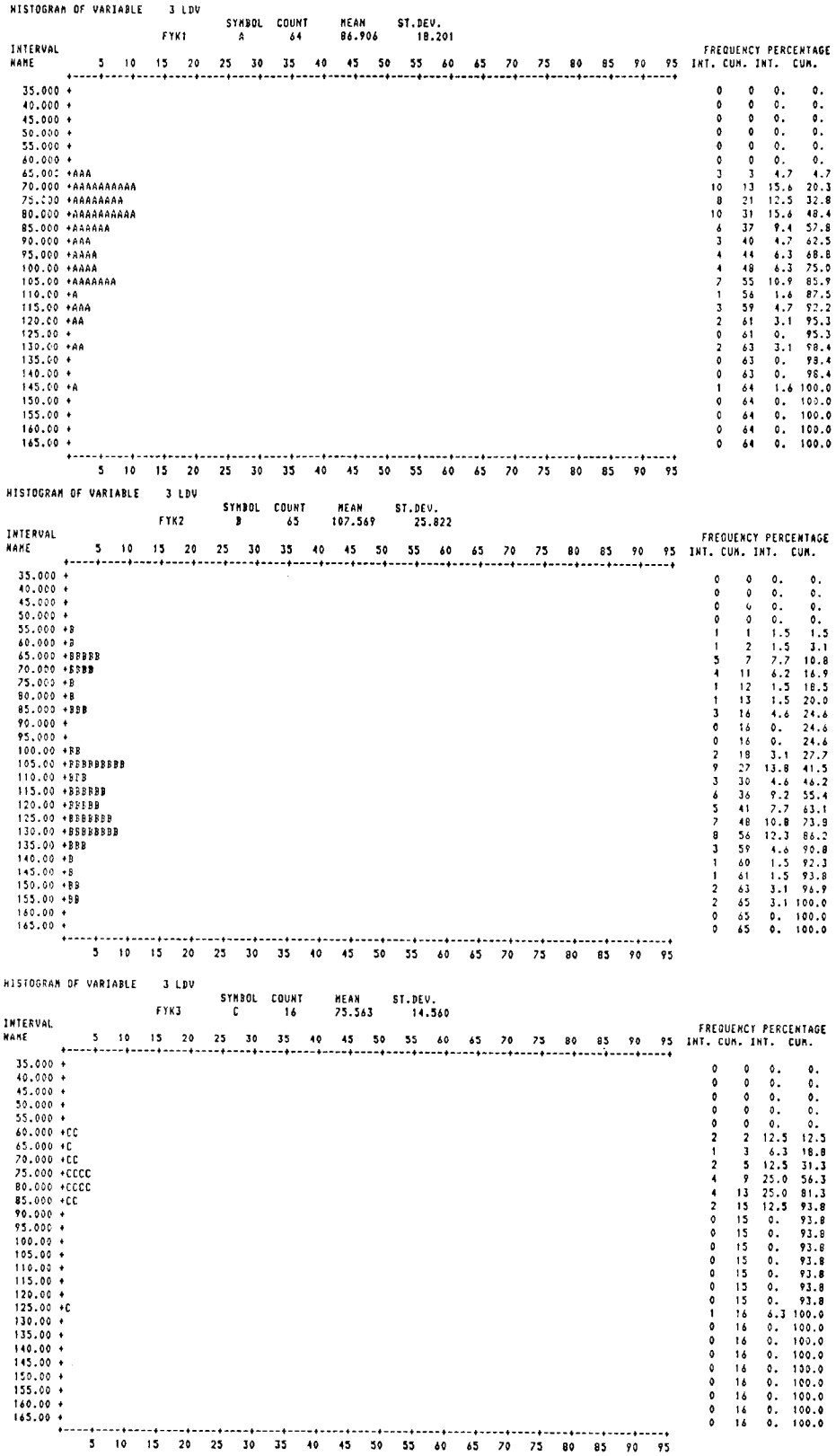


Figure 7. Length-frequency distributions of juvenile Dolly Varden char captured in the FYK1 net, in the FYK2 net, and in the FYK3 net at Trap Bay, southeast Alaska, 1980.



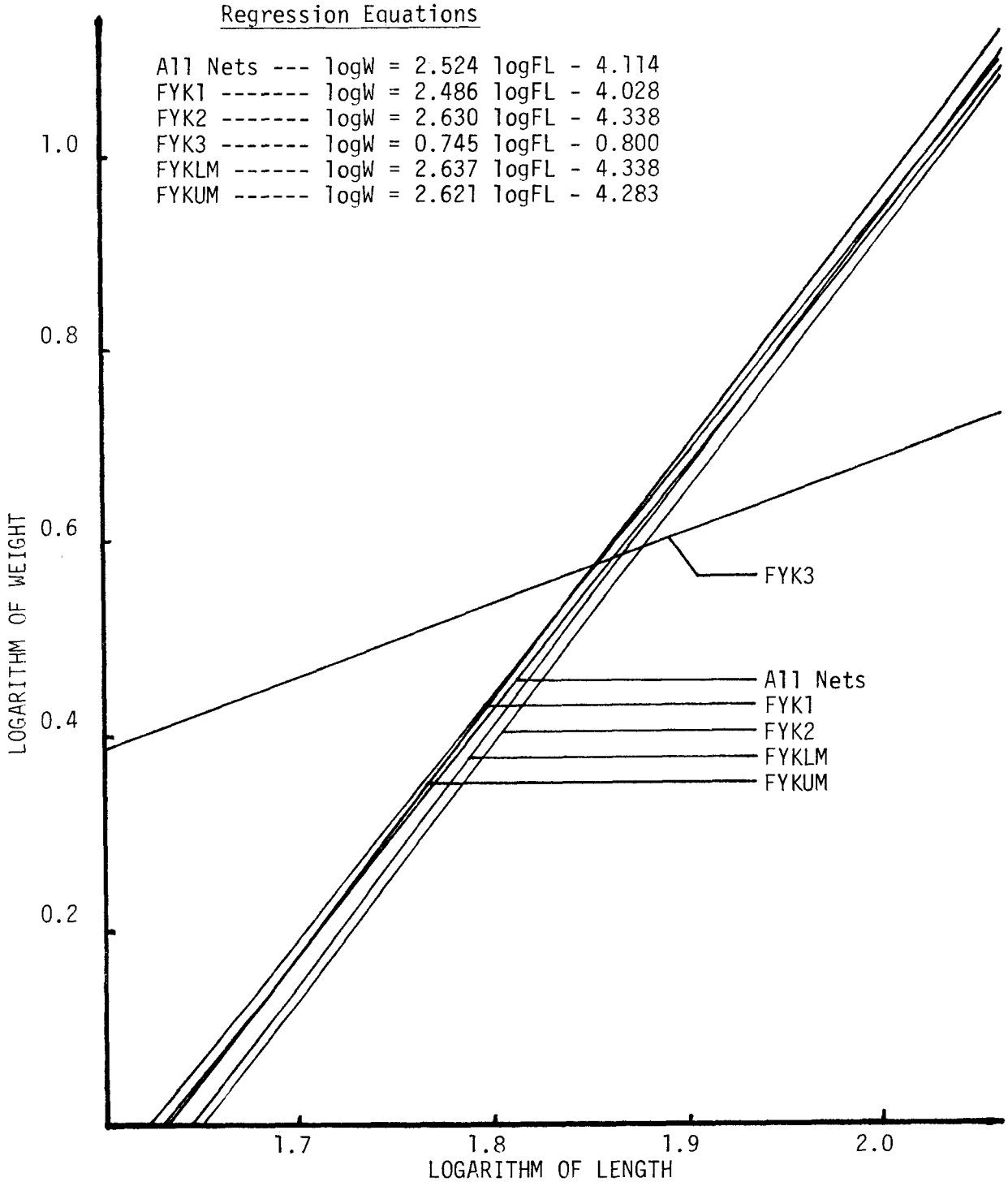


Figure 8. Weight-length regression lines for juvenile Dolly Varden char captured in five fyke nets, in the FYK1 net, in the FYK2 net, in the FYK3 net, in the FYKLM net, and in the FYKUM net at Trap Bay, southeast Alaska, 1980.

Table 6. Numbers of cottids captured in fyke nets at Trap Bay, spring, 1980.

DATE	FYK1	FYK2	FYK3	FYKUM	FYKLM	TOTAL
4/29	8	3	*	*	*	11
4/30	*	0	0	*	*	0
5/1	1	5	3	*	*	9
5/2	0	1	0	*	*	1
5/3	0	2	0	*	*	2
5/4	4	4	0	*	*	8
5/5	1	3	1	*	*	5
5/6	2	5	0	*	*	7
5/7	0	7	0	*	*	7
5/8	1	3	0	*	*	4
5/9	0	2	0	3	3	8
5/10	1	3	0	3	0	7
5/11	0	8	0	2	0	10
5/12	0	1	0	0	0	1
5/13	0	2	0	6	6	14
5/14	0	1	0	3	17	21
5/15	0	0	0	4	7	11
5/16	0	0	0	2	13	15
5/17	0	0	0	0	23	23
5/18	0	5	0	5	18	28
5/19	*	6	0	0	13	19
5/20	0	3	0	2	9	14
5/21	3	2	0	0	10	15
5/22	0	1	0	2	11	14
5/23	4	6	0	1	12	23
5/24	2	0	0	0	15	17
5/25	5	3	0	0	14	22
5/26	1	2	0	2	8	13
5/27	2	1	0	0	10	13
5/28	4	3	0	5	6	18
5/29	3	3	0	2	13	21
5/30	0	1	0	0	11	12
5/31	0	1	0	0	9	10
6/1	0	0	0	0	7	7
6/2	3	0	0	5	6	14
6/3	3	0	0	2	15	20
6/4	2	0	0	0	6	8
6/5	2	2	0	0	1	5
6/6	1	1	0	0	0	2
6/7	1	0	0	1	0	2
6/8	2	0	0	*	*	2
6/9	*	*	*	*	*	0
6/10	*	*	*	*	*	0
6/11	*	*	*	*	*	0

Table 6. (Cont'd.) Numbers of cottids captured in fyke nets at Trap Bay, spring, 1980.

DATE	FYK1	FYK2	FYK3	FYKUM	FYKLM	TOTAL
6/12	*	*	*	*	*	0
6/13	*	*	*	*	*	0
6/14	0	0	1	*	*	1
6/15	0	0	0	*	*	0
6/16	*	*	*	*	*	0
6/17	3	11	0	*	*	14
6/18	0	2	0	*	*	2
6/19	4	1	0	*	*	5
6/20	1	1	0	*	*	2
TOTAL	64	105	5	50	263	487

* Fyke net was not operating.

Figure 9. Length-frequency distributions of cottids captured in five fyke nets, in the FYKLM net, and in the FYKUM net at Trap Bay, southeast Alaska, 1980.

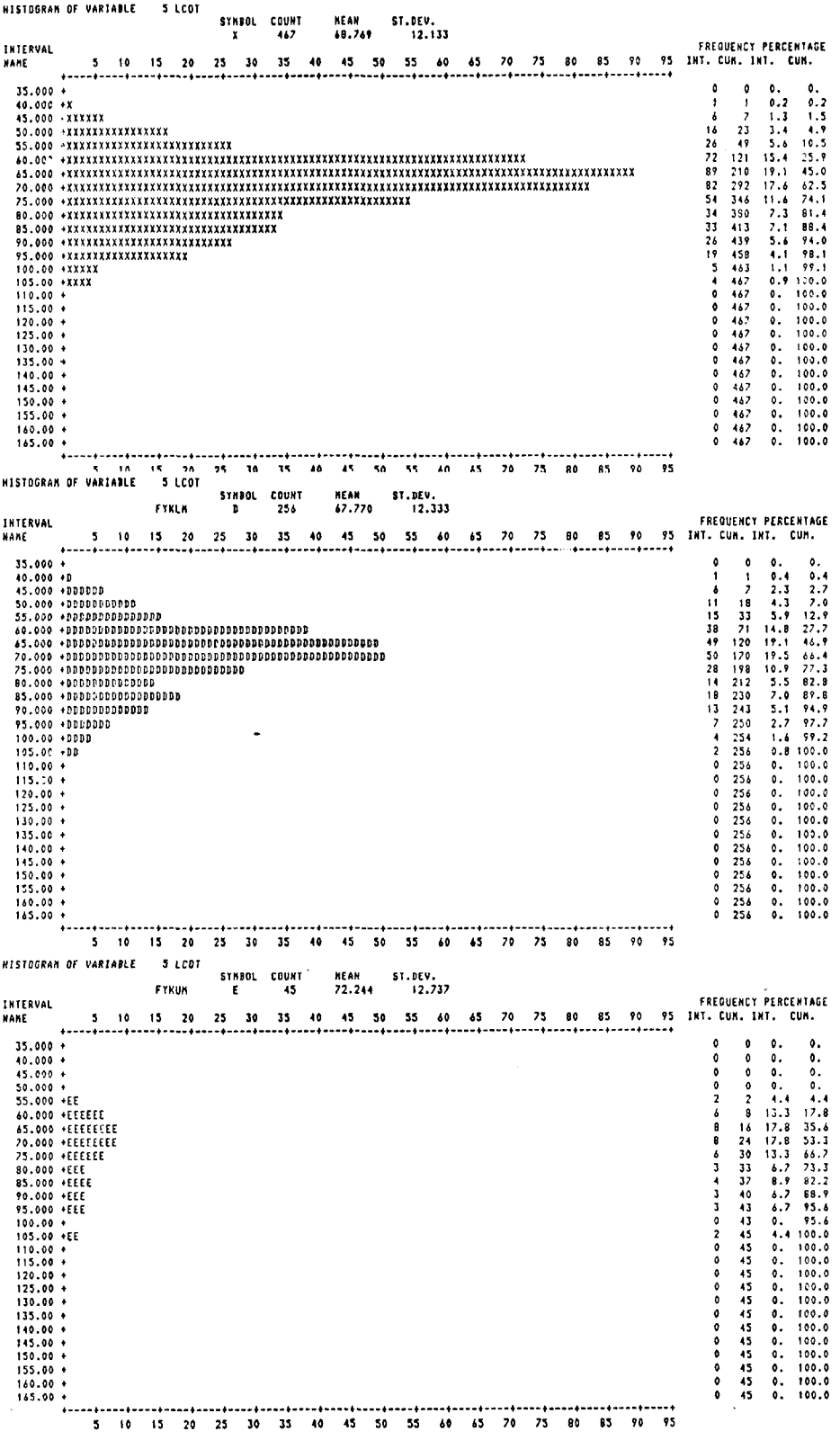
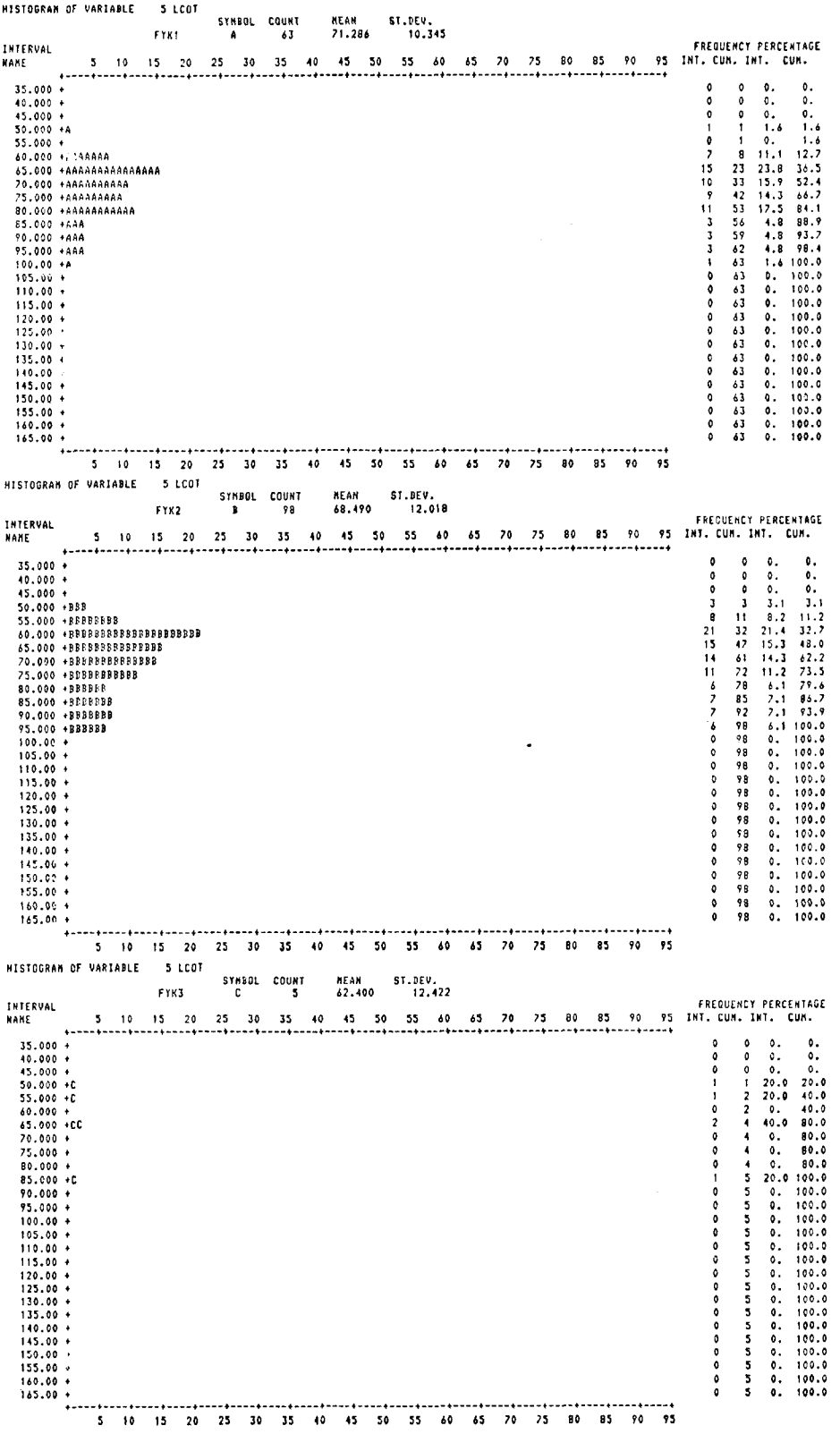


Figure 10. Length-frequency distributions of cottids captured in the FYK1 net, in the FYK2 net, and in the FYK3 net at Trap Bay, southeast Alaska, 1980.



The weight-length relationships of cottids sampled at the five fyke nets were more diverse than the relationships displayed by young char and coho. Figure 11 displays the weight-length regression lines and the regression equations for cottids. The sample sizes (n) and r^2 values are as follows:

Location	n	r^2
All nets	137	0.59
FYK1	12	0.84
FYK2	52	0.37
FYKLM	48	0.86
FYKUM	23	0.89

These values indicate that the correlations between the logarithm of weight (log w) and the logarithm of fork-length (log FL) are all significant at the 0.01 level. It should be noted, however, that the r^2 value of 0.37 for FYK2 indicates that only 37% of the variation in weight is accounted for by the linear relationship between log FL and log W.

Upstream Migrants

A total of 3,509 pink salmon, 2,210 Dolly Varden char, 29 coho salmon (including 17 jacks), 19 cutthroat trout, 2 rainbow trout, and 2 chum salmon were enumerated at the weir during the period from August 13 through October 20, 1980. Periodic stream counts indicated that at least 41 chum salmon were in the stream before the weir was functional and that approximately 1,280 pink salmon spawned below the weir site. These figures, plus the weir counts, indicate an estimated chum salmon escapement of at least 43 adults and a pink salmon escapement of approximately 4,800 adults. The daily counts of pink salmon and Dolly Varden char passing the weir, as well as daily records of water temperature and water depth, are presented in Table 7.

The mean length (mid-eye to fork) of 400 pink salmon sampled at the weir was 459.5 mm with a standard deviation of 33.0 mm. The lengths ranged from 353 to 565 mm. The mean weight of 122 pink salmon sampled at the weir was 1.8 kg with a standard deviation of 0.4 kg. These weights ranged from 1.1 to 2.9 kg. The length-frequency distribution for 400 pink salmon sampled at the weir is shown in Figure 12 and their weight-length relationship derived from a sample of 101 adults is presented in Figure 13.

The mean length of 1,981 Dolly Varden char sampled at the weir was 210.9 mm with a standard deviation of 47.4 mm and a range of 107 to 457 mm. The mean weight of 415 char sampled at the weir was 106.9 grams with a standard deviation of 79.3 grams. These weights ranged from 19.2 to 1000.0 grams.

The length-frequency distribution for 1,991 char sampled at the weir is presented in Figure 14, and the weight-length relationship of a sample of 415 char is shown in Figure 15.

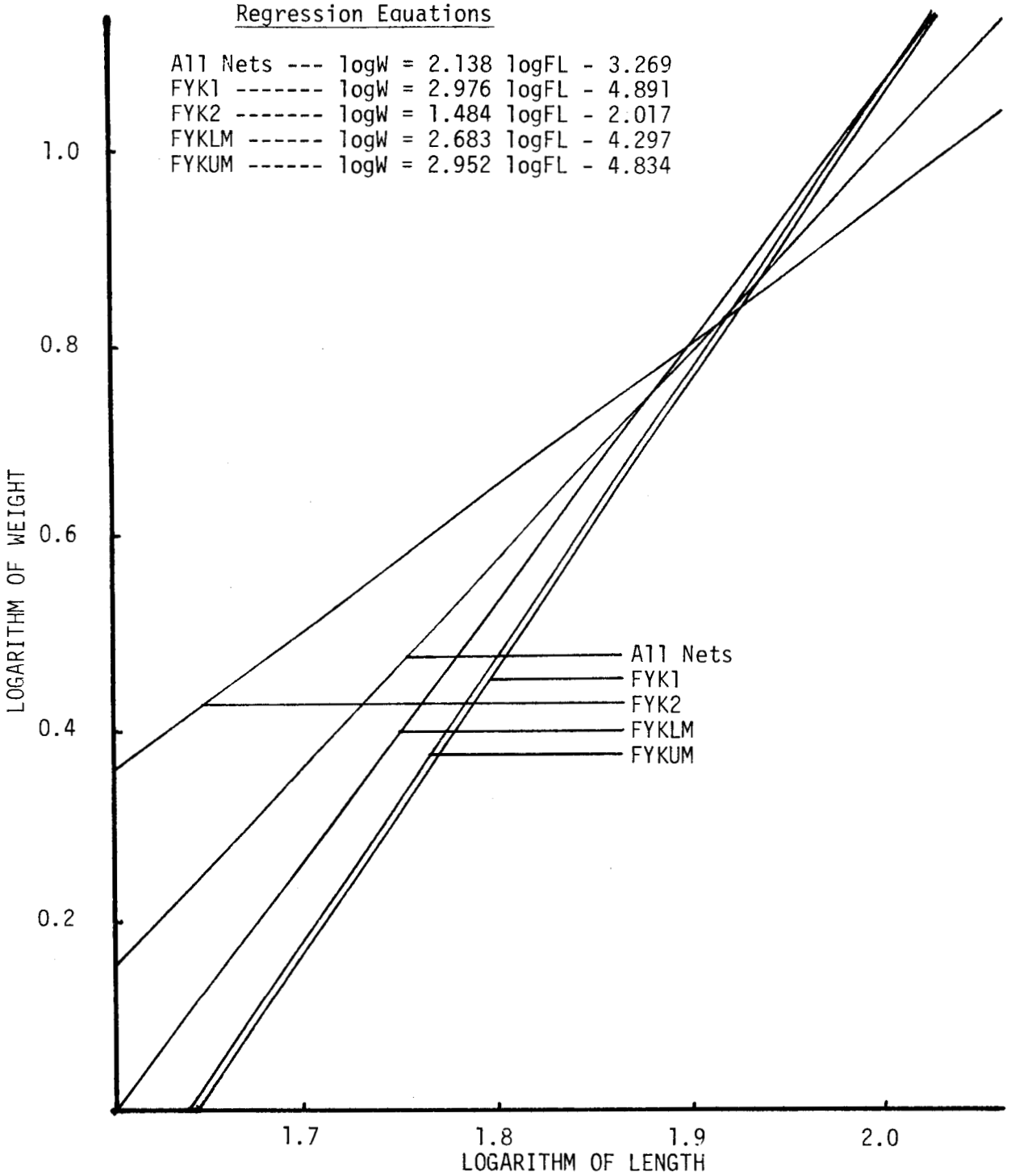


Figure 11. Weight-length regression lines for cottids captured in five fyke nets, in the FYK1 net, in the FYK2 net, in the FYKLM net, and in the FYKUM net at Trap Bay, southeast Alaska, 1980.

Table 7. Adult pink salmon enumerated through weir by day and daily water temperatures and water depths, 1980.

Date	Number of Pink Salmon	Water Temperature (°C)	Water Depth (mm)	Number of Dolly Varden
8/11	53	7.5	90	0
8/12	115	7.5	101	0
8/13	85	7.5	98	0
8/14	13	7.0	87	0
8/15	144	6.5	98	2
8/16	160	7.0	144	1
8/17	39	7.0	159	2
8/18	17	7.0	111	0
8/19	47	7.0	92	1
8/20	56	6.5	100	0
8/21	72	...	92	0
8/22	73	6.8	95	1
8/23	239	7.1	90	0
8/24	136	6.3	90	0
8/25	322	7.2	92	1
8/26	124	6.4	84	1
8/27	172	6.6	81	2
8/28	571	7.0	69	2
8/29	210	6.6	208	7
8/30	43	6.8	118	0
8/31	202	6.8	100	3
9/1	31	6.0	196	14
9/2	8	6.0	120	2
9/3	115	6.8	133	4
9/4	19	6.4	192	4
9/5	111	6.5	230	5
9/6	5	6.0	193	30
9/7	2	6.0	250	59
9/8	267	6.0	250	81
9/9	8	6.0	252	22
9/10	8	6.5	198	263
9/11	9	6.5	193	201
9/12	4	6.0	160	42
9/13	11	6.0	132	145
9/14	8	7.0	322	77
9/15	7	7.0	229	84
9/16	2	7.0	165	41
9/17	0	7.0	230	85
9/18	0	7.0	152	66
9/19	1	6.5	338	276*
9/20	0	6.0	208	240

Table 7. (Cont'd) Adult pink salmon enumerated through weir by day and daily water temperatures and water depths, 1980.

Date	Number of Pink Salmon	Water Temperature (°C)	Water Depth (mm)	Number of Dolly Varden
9/21	0	6.0	258	69
9/22	0	5.8	360	82
9/23	0	5.8	268	20
9/24	0	6.3	227	30
9/25	0	6.4	277	64
9/26	0	6.2	209	38
9/27	0	6.9	229	12
9/28	0	6.5	229	0
9/29	0	6.7	399	25
9/30	0	6.7	408	8
10/1	**	6.6	over the top	**
10/2	**	6.4	338	**
10/3	0	6.9	383	23*
10/4	0	6.9	368	9*
10/5	**	6.8	560	**
10/6	**	6.8	400	**
10/7	0	6.8	425	9*
10/8	0	6.8	540	8*
10/9	0	6.5	498	4*
10/10	0	6.5	377	9
10/11	0	6.3	368	22
10/12	0	5.3	365	7
10/13	0	5.1	260	7
TOTAL	3,509			2,210

* Weir was not in operation for the full 24 hour period.
** Weir was not in operation.

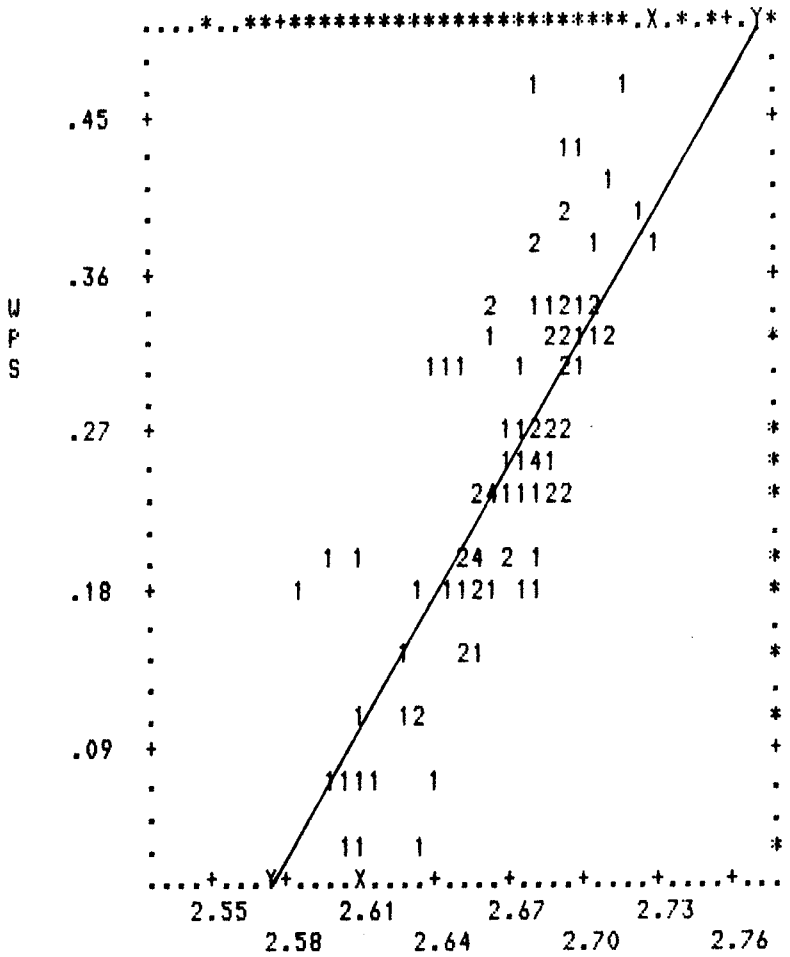
HISTOGRAM OF VARIABLE 2 LENGTH

SYMBOL	COUNT	MEAN	ST.DEV.
X	400	459.482	32.993

INTERVAL NAME	5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80	FREQUENCY INT.	FREQUENCY CUM.	PERCENTAGE INT.	PERCENTAGE CUM.
350.00	+	0	0	0.	0.
360.00	+X	1	1	0.3	0.3
370.00	+X	1	2	0.3	0.5
380.00	+X	1	3	0.3	0.8
390.00	+XXXXX	5	8	1.3	2.0
400.00	+XXXXXXXXXX	10	18	2.5	4.5
410.00	+XXXXXXXXXXXXXXX	15	33	3.8	8.3
420.00	+XXXXXXXXXXXXXXXXXXXXXXXXX	25	58	6.3	14.5
430.00	+XXXXXXXXXXXXXXXXX	17	75	4.3	18.8
440.00	+XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	34	109	8.5	27.3
450.00	+XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	42	151	10.5	37.8
460.00	+XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	38	189	9.5	47.3
470.00	+XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	47	236	11.8	59.0
480.00	+XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	51	287	12.8	71.8
490.00	+XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	36	323	9.0	80.8
500.00	+XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	46	369	11.5	92.3
510.00	+XXXXXXXXXXXXX	13	382	3.3	95.5
520.00	+XXXXXXXXXXX	11	393	2.8	98.3
530.00	+XXX	3	396	0.8	99.0
540.00	+XX	2	398	0.5	99.5
550.00	+	0	398	0.	99.5
560.00	+X	1	399	0.3	99.8
570.00	+X	1	400	0.3	100.0
580.00	+	0	400	0.	100.0
590.00	+	0	400	0.	100.0
600.00	+	0	400	0.	100.0
LAST	+	0	400	0.	100.0

5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80

Figure 12. Length-frequency distribution of adult pink salmon captured at the Trap Bay weir, southeast Alaska, 1980, (mid-eye to fork lengths in mm).



N= 101
COR= .786

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
X	2.6694	.03082	X= .25047*Y+ 2.6064	366E-6
Y	.25158	.09676	Y= 2.4696*X-6.3408	.00361

Figure 13. Weight-length regression for adult pink salmon captured at the Trap Bay weir, southeast Alaska, 1980, (WPS = logarithm of the weight in kg, LENGTH = logarithm of the length in mm).

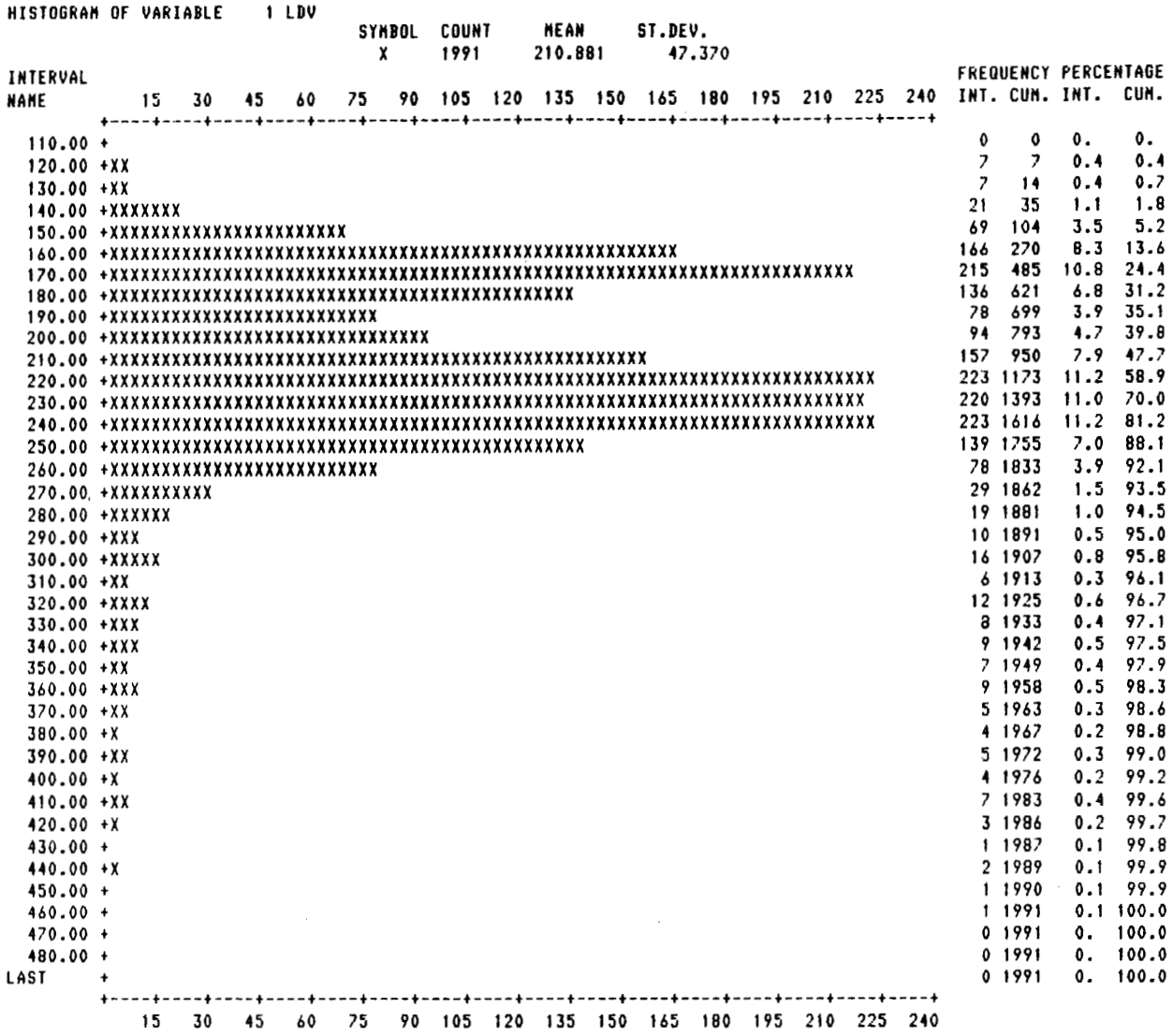
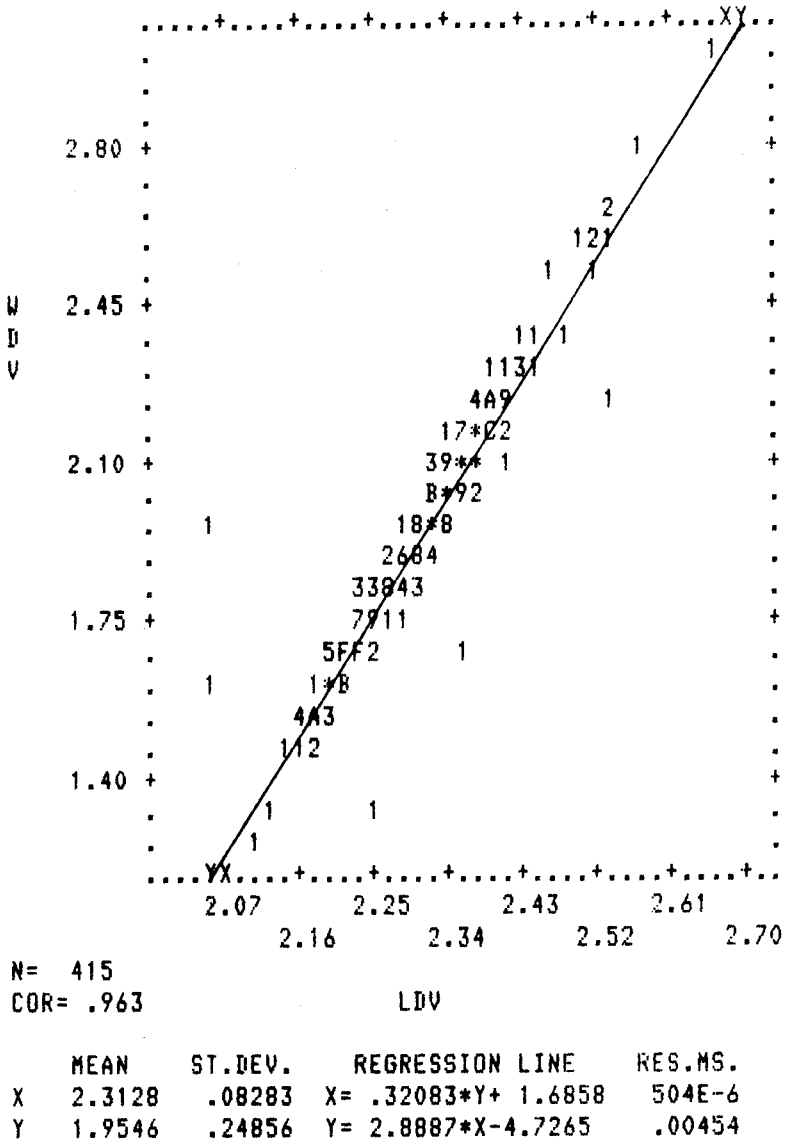


Figure 14. Length-frequency distribution of adult Dolly Varden char captured at the Trap Bay weir, southeast Alaska, 1980, (nose to fork lengths in mm).



N= 415
COR= .963

	MEAN	ST.DEV.	REGRESSION LINE	RES.MS.
X	2.3128	.08283	X= .32083*Y+ 1.6858	504E-6
Y	1.9546	.24856	Y= 2.8887*X-4.7265	.00454

Figure 15. Weight-length regression for adult Dolly Varden char captured at the Trap Bay weir, southeast Alaska, 1980, (WDV = logarithm of the weight in grams, LDV = logarithm of the nose-to-fork length in mm).

Overwinter Studies

No suitable sites for overwinter studies were found at the Trap Bay research site. The search for appropriate sites will continue during the next field season.

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APPENDIX

Table 1. Water temperature and water depth at the Trap Bay fyke net sites, 1980.

Date	Mainstem Fyke (L) Temp. °C	Mainstem Fyke (L) Depth mm	Fyke 1 Temp. °C	Fyke 2 Temp. °C	Fyke 3 Temp. °C
April 22	3.5	...	...	...	...
23	4.2	...	...	...	...
24	3.9	...	...	...	...
25	4.0	...	...	...	...
26	4.0	...	...	...	...
27	4.0	...	...	...	...
28	4.0	...	...	...	...
29	4.0	...	...	...	...
30	4.0	...	...	...	...
May 1	4.0	249	3.0	4.0	4.0
2	4.0	271	4.0	4.5	4.0
3	4.0	178	4.5	6.0	4.5
4	4.0	148	5.0	6.0	4.5
5	5.0	139	4.0	7.0	5.0
6	5.0	182	5.0	6.0	5.0
7	5.0	247	4.0	5.0	5.0
8	4.0	273	4.0	5.0	5.0
9	4.0	208	4.5	7.0	4.5
10	5.0	201	5.5	7.0	4.5
11	5.0	189	4.0	7.5	5.5
12	5.0	183	7.0	8.0	5.0
13	4.0	233	5.5	8.5	5.0
14	4.75	227	4.5	7.0	5.5
15	5.5	221	5.0	8.0	5.0
16	5.0	223	6.0	9.0	5.5
17	4.5	229	5.0	8.0	6.0
18	5.0	225	5.0	8.0	5.5
19	4.7	435	...	6.0	5.5
20	5.0	273	...	6.0	5.0
21	4.5	201	...	6.0	5.0
22	4.5	177	...	7.0	5.0
23	4.0	158	4.5	6.5	5.0
24	5.0	...	5.0	8.0	5.0
25	4.5	180	6.0	8.0	6.0
26	5.0	102	6.5	9.0	6.0
27	4.0	209	6.0	8.5	6.5
28	5.0	241	6.0	9.0	6.0
29	5.0	202	6.5	9.0	...
30	5.0	189	6.0	8.0	6.0
31	4.5	232	6.0	8.0	6.0

Table 1. (Cont'd.) Water temperature and water depth at the Trap Bay fyke net sites, 1980.

Date	Mainstem Fyke (L) Temp. °C	Mainstem Fyke (L) Depth mm	Fyke 1 Temp. °C	Fyke 2 Temp. °C	Fyke 3 Temp. °C
June 1	6.0	170	7.0	9.0	6.5
2	5.0	158	6.0	9.0	6.6
3	5.5	190	7.0	11.0	6.0
4	5.0	242	8.0	11.0	8.0
5	4.5	293	8.0	11.5	8.0
6	4.5	278	8.0	13.0	8.0
7	4.5	248	8.0	13.0	8.0
8	4.5	210	8.0	11.0	8.0
9	...	201	...	...	...
10	...	...	...	...	...
11	...	...	...	...	...
12	...	...	...	...	...
13	...	...	...	...	...
14	...	...	...	...	9.0
15	...	...	9.0	10.0	8.5
16	...	...	...	...	...
17	5.5	138	8.0	9.0	7.5
18	5.5	124	...	9.5	7.5
19	5.5	123	7.5	9.5	7.5
20	5.5	108	8.5	...	7.0
21	5.5	109	...	...	...
22	5.5	178	...	...	...
23	5.5	189	...	...	...
24	4.5	132	...	...	...
25	5.5	128	...	...	...
26	5.5	128	...	...	...
27	5.0	132	...	...	...
28	5.5	115	...	...	...
29	5.5	112	...	...	...
30	5.5	98	...	...	...

Table 2. Mainstem water depth and temperature at Trap Bay, July 1-October 24, 1980.

Date	Temp. °C	Depth mm	Date	Temp. °C	Depth mm
July 1	5.1	99	Aug. 1	6.0	143
2	5.5	133	2	6.0	129
3	5.5	180	3	6.0	100
4	6.0	100	4	6.0	100
5	6.0	98	5	6.5	84
6	5.5	93	6	6.5	88
7	5.0	91	7	6.5	78
8	5.0	85	8	6.5	84
9	5.5	81	9	7.0	88
10	5.5	70	10	7.5	98
11	5.3	80	11	7.0	90
12	5.4	95	12	7.5	101
13	...	...	13	7.5	98
14	5.3	100	14	7.0	87
15	5.5	80	15	6.5	98
16	5.5	79	16	7.0	144
17	5.6	70	17	7.0	159
18	5.6	59	18	7.0	111
19	5.5	121	19	7.0	92
20	5.8	124	20	6.5	100
21	5.8	140	21	...	92
22	5.9	112	22	6.8	95
23	5.8	110	23	7.1	90
24	5.9	100	24	6.3	90
25	6.2	85	25	7.2	92
26	6.2	75	26	6.4	84
27	6.3	70	27	6.6	81
28	6.4	60	28	7.0	69
29	6.5	72	29	6.6	208
30	6.0	...	30	6.8	118
31	6.0	...	30	...	...

Table 2. (Cont'd.) Mainstem water depth and temperature at Trap Bay, July 1-October 24, 1980.

Date	Temp. °C	Depth mm	Date	Temp. °C	Depth mm
Sept. 1	6.0	196	Oct. 1	6.6	1,000+
2	6.0	120	2	6.4	338
3	6.8	133	3	6.8	383
4	6.4	192	4	6.9	368
5	6.5	230	5	6.8	560
6	6.0	193	6	6.8	400
7	6.0	146	7	6.8	425
8	6.0	250	8	6.8	540
9	6.0	252	9	6.5	498
10	6.5	198	10	6.5	377
11	6.5	193	11	6.3	368
12	6.0	160	12	5.3	265
13	6.0	132	13	5.1	260
14	7.0	322	14	4.7	198
15	7.0	229	15	6.0	210
16	7.0	460	16	6.0	770
17	7.0	230	17	6.0	675
18	7.0	152	18	6.0	410
19	6.5	338	19	6.0	375
20	6.0	208	20	6.0	310
21	6.0	258	21	6.0	250
22	5.7	360	22	6.0	208
23	5.7	268	23	6.0	200
24	6.3	227	24	6.0	130
25	6.4	277			
26	6.2	209			
27	6.9	229			
28	6.5	229			
29	6.7	399			
30	6.7	408			

Table 3. Fifteen collection sites subject to macrobenthos sampling.

Site Name	Stream	Type of Sample		Treatment		
		Benthos	Drift	Logged	Below	Control
LU9	Unit 9 Stream	X	X		X	
UU9	Unit 9 Stream	X	X	X		
CNTR	Control Creek	X	X			X
6494	6494 road location	X	X			X
U7	Unit 7 Stream	X	X	X		
U4BF	Unit 4 Below Fork	X	X		X	
U4UL	Unit 4 Upper Left Fork	X		X		
U4RF	Unit 4 Upper Left Fork	X		X		
MSLF	Mainstream Right Fork	X	X			X
MSRF	Mainstream Right Fork	X	X			X
MSF	Mainstream Forks	X	X		X	
MS7	Mainstream below Unit 7	X	X		X	
MS9	Mainstream below Unit 9	X	X		X	
LMS	Lower Mainstream	X	X		X	
U3a	Unit 3a Stream	X	X		X	